Nalco Docket No. 7773
Customer No. 49459

In the United States Patent and Trademark Office

Applicants:	Michael R. St. John et al.	)	Examiner: Dennis R. Cordray
Serial No.:	10/764,935	)	Group Art Unit: 1791
Date Filed:	January 26, 2004	)	

For: METHOD OF USING ALDEHYDE-FUNCTIONALIZED POLYMERS TO ENHANCE PAPER MACHINE DEWATERING

DECLARATION OF MICHAEL R. ST. JOHN UNDER 37 C.F.R. § 1.132

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Michael R. St. John, declare as follows:

1. I am a co-inventor of U.S. Patent Application Serial No. 10/764,935, entitled "Method of Using Aldehyde-Functionalized Polymers to Enhance Paper Machine Dewatering," which was filed on January 26, 2004 and is now pending.

2. I attended and graduated from University of Wisconsin, Madison, receiving a B.S. degree in chemistry; University of California, Berkeley, receiving a Ph.D. degree in physical chemistry; and University of Chicago as a postdoctoral fellow.

3. I am currently employed as a Research Associate in the Pulp & Paper Research department at Nalco Company. My employment with Nalco Company began in August of 1983. Prior to that date, I was employed at Institute of Gas Technology where I was Principal Scientist of Solar and Electrochemical Research. Prior to my employment at Institute of Gas Technology, I was employed by University of Wisconsin, Milwaukee as lecturer. I have a total of 20 years experience in the pulp and paper industry.

4. I have read and understood the above-captioned patent application and the pending Office Action dated June 19, 2007.

Summary

5. The purpose of this Declaration is (i) to explain how the polymers described in the above-captioned patent application and currently sold by Nalco Company under the tradenames Metrix® and Velox™ (the same products as in the Declaration of Ms. Laura C. Copeland) differ from those disclosed in U.S. Patent No. 3,556,932 to Coscia et al. ("Coscia") and (ii) to explain why the increased press dewatering effect observed at high glyoxalation is surprising and unexpected based upon the state of the art at the time the invention was made and in light of the disclosure of Coscia.

6. The polymers of this invention are distinct from the polymers of Coscia because the polymers of this invention include: (i) a significantly higher amount of unreacted glyoxal; (ii) a significantly higher amount of di-reacted amino or amido groups; and (iii) a minimum level of di-reacted amino or amido groups.

7. Coscia provides temporary wet strength data for its polymers. Based on wet strength activity discussed in Coscia, the increase in press section dewatering activity observed for the polymers of this invention is surprising and unexpected. In light of the teachings of Coscia, conventional dewatering tests, and the traditional use of polymers in tissue and towel grades, the fact that any dewatering increase would be observed through the use of the polymers of the invention is surprising and unexpected.

The Polymers of This Invention are Distinct from the Polymers of Coscia

8. Coscia indicates that in its polymers, about ½ (i.e., 50 mol%) of the glyoxal does not react with the starting material polymer (see for example column 6, lines 40 to 44 and column 8, lines 55 to 56). As shown in Table 1, it is evident that the amount of unreacted glyoxal in our polymers can vary from 28 mol% at an added glyoxal/AcAm mole ratio of 0.1 to 74 mol% at a ratio of 0.8. The polymers of the present invention

having total amide reacted greater than 20 mol% (i.e., mono-reacted of 11 mol%) have un-reacted glyoxal significantly greater than 50 mol%.

Table 1

Examples of Distributions of Acrylamide Types and Unreacted Glyoxal for Polymers Prepared with Different Added Glyoxal to AcAm Ratios as Measured by C^{13} NMR

Sample	Glyoxal Added/ AcAm Mole Ratio	Un-Reacted AcAm, mol%	Mono - Reacted AcAm, mol%	Di - Reacted AcAm, mol%	Total amide reacted, mol%	Un-Reacted Glyoxal, mol%
A	0.1	91	4	5	9	28
B	0.2	87	7	6	13	49
C	0.4	80	11	9	20	61
D	0.8	74	17	9	26	74

9. The amount of di-reacted acrylamide groups present in the polymer is different. Although Coscia does not quantitatively specify the amount of di-reacted acrylamide present in its polymers, Coscia does specify its presence as a "very small amount" (see for example, column 6, line 47). Inspection of Table 1 shows that di-reacted acrylamides in the polymers of the above-captioned application are present at comparable levels to the mono-reacted acrylamide ranging from values greater than the mono-reacted at an added glyoxal to acrylamide mole ratio of 0.1 to 53% of the mono-reacted acrylamide at a mole ratio of 0.8. By conventional standards, these amounts would not be considered to be present in a "very small amount."

Increased Press Dewatering Effect

10. Coscia teaches the use of a certain type of glyoxalated polymer as only a temporary wet strength additive. Chemical additives that improve the dewatering in the press sections of paper machines were unknown in the art at the time this invention was made.

11. Temporary wet strength additives are used in tissue and towel grades of paper, which are manufactured on machines that do not have press sections for dewatering. Thus, the benefit of additives in grades that do incorporate press sections in their manufacture, like paperboard and printing & writing papers, was not discovered until about 30 years after the introduction of wet strength additives to tissue and towel grades. Today, most papermakers outside of those currently using such products are unaware that any chemical additive can provide improvement in press section dewatering.

12. Conventional dewatering provided by polymers (usually referred to as retention aids) occurs in the forming section of the machine and reflects increases in drainage or dewatering rate. Laboratory tests to evaluate retention aids for dewatering consist of filtration tests with or without vacuum applied, and the drainage rate as measured by either a time to drain a fixed volume or the volume drained in a fixed time are the output of these devices. These tests are well known to those in the papermaking field. Examples would be the CSF (Canadian standard freeness), the DDA (dynamic drainage analyzer) from YKI, Sweden, and the DFS (dynamic filtration system from Mutek]). Figures 1 and 2 show conventional dewatering data from a vacuum filtration apparatus for the glyoxalated polymers of this application, compared to conventional polymers used as drainage aids. As shown in Figure I, glyoxalated polymers at two glyoxal levels provided no increase in drainage rate while the conventional cationic polyacrylamide used as a drainage aid showed a dramatic increase in drainage rate. To show this is not unique to this furnish, Figure 2 shows basically the same result in furnish from another mill. Within experimental error, the glyoxalated polymer shows at best little activity even at high doses. Based on results from conventional dewatering tests, one skilled in the art would conclude that aldehyde-functionalized polymers would be of no use whatsoever for improving press section dewatering in paper applications.

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Figure 1
Polymer Dosage Curves of VDT+ [Vacuum Filtration Test] Drainage Rate in 100% Recycle OCC Furnish from Mill A

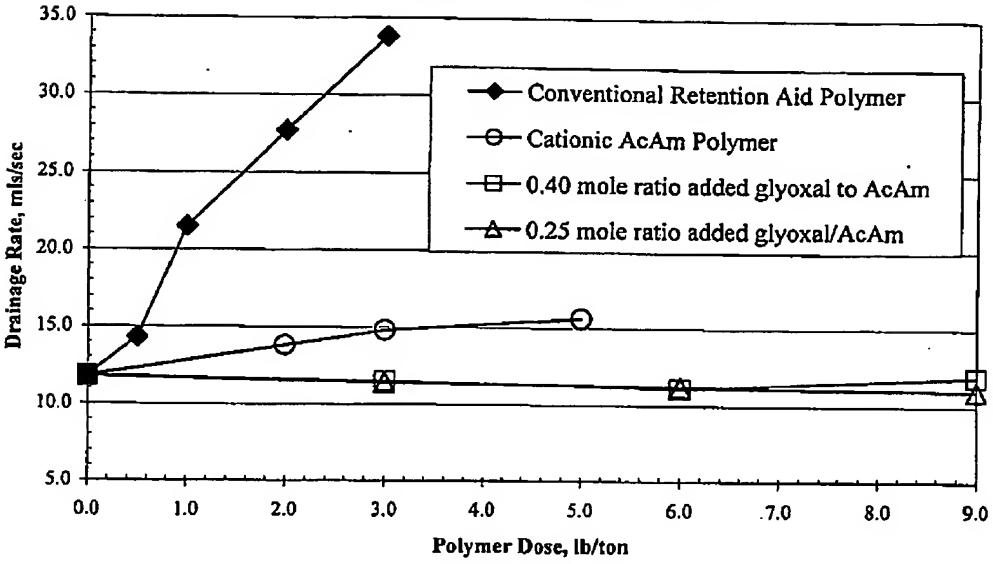
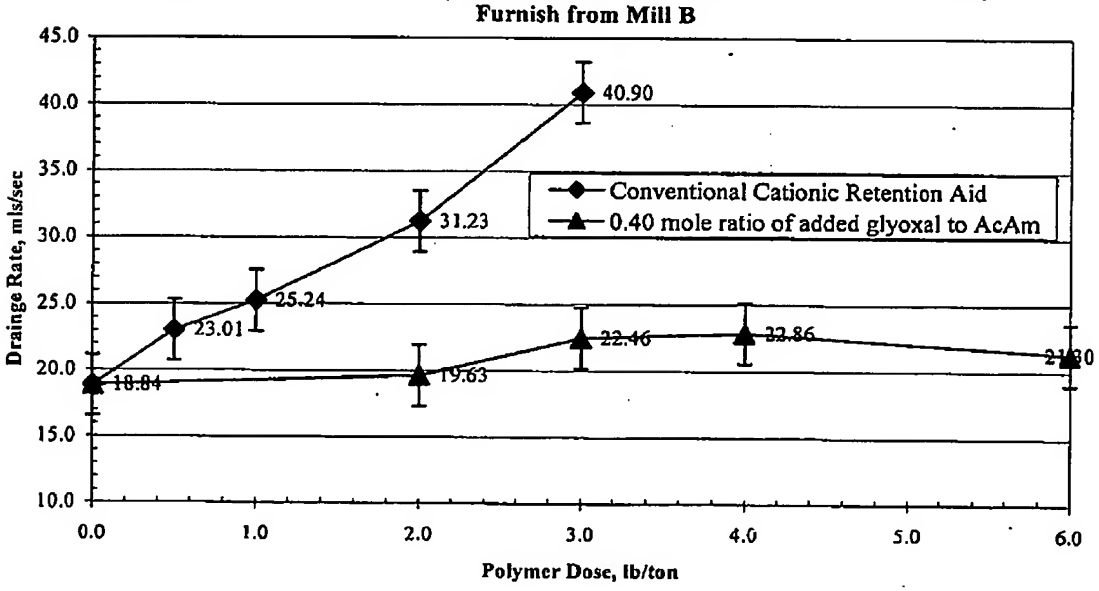


Figure 2
Polymer VDT+ [Vacuum Filtration Test] Drainage Rate Curves in 100% Recycle Furnish from Mill B



13. No laboratory test of any sort for evaluating the press dewatering effect of chemicals exists in the art. Consequently, conventional dewatering tests are relied upon to identify dewatering effects of chemicals, and as noted in the previous paragraph, aldehyde-functionalized polymers would not demonstrate any activity in conventional dewatering tests. Because of the difficulties associated with evaluating the efficacy of such chemicals in press section dewatering, complex paper machine trial data was presented in the original application based on spraying the polymers just before the press section and monitoring the resulting dryness of the sheet that is automatically translated into steam usage reduction as followed by steam pressure (see example 3 of the instant patent application).

14. The series of polymers in Table 1 were evaluated during several paper machine trials with the surprising and unexpected discovery that increasing the added glyoxal to acrylamide ratio from 0.1 to 0.8 (i.e., minimum total acrylamide reacted from 0.09 to 0.26) increased the press section dewatering effect.

15. In light of conventional dewatering tests and the traditional use of polymers in tissue and towel grades, the fact that any dewatering increase would be observed is surprising and unexpected. In addition, increased press dewatering activity with higher levels of glyoxalation would be surprising and unexpected based on the disclosure of Coscia. Figure 3 shows the wet strength activity and the press dewatering activity of the Coscia polymers (peak at 0.12 with downward slope thereafter) and the polymers of this invention. Wet strength activity reaches a maximum at a total glyoxal reacted to acrylamide mole ratio of 0.12 (as taught in Coscia) while dramatic increases in press section dewatering continue to be achieved all the way to a total reacted glyoxal ratio of at least 0.26.

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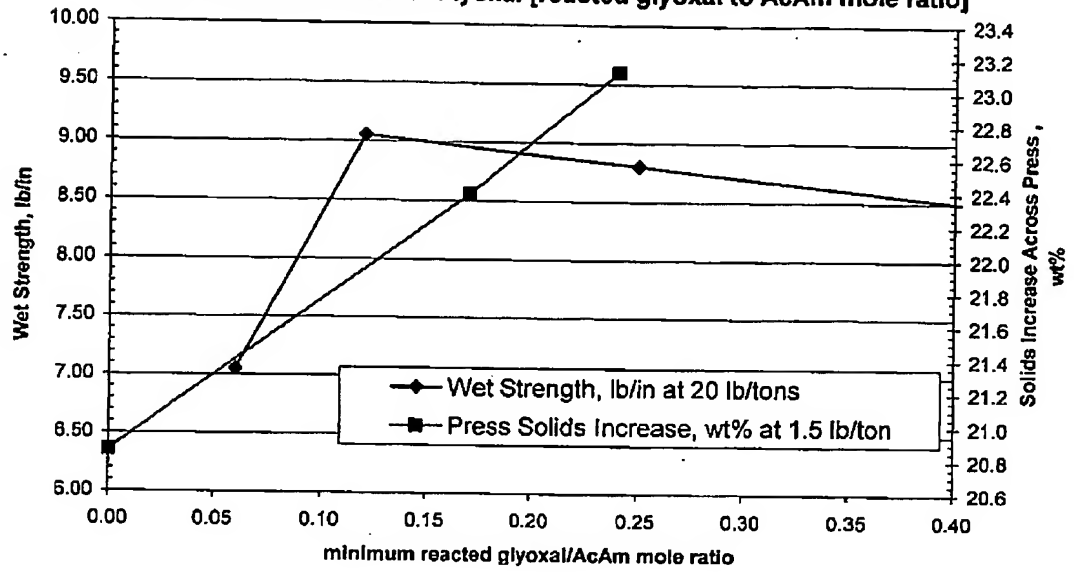
Figure 3
Comparison of Wet Strength Increase and Press Dewatering Increase with Total Amide Reacted with Glyoxal [reacted glyoxal to AcAm mole ratio]



16. Based on wet strength activity discussed in Coscia, no increase in press section dewatering activity would be predicted when the ratio of added glyoxal increases from 0.4 to 0.8, which is contrary to the press dewatering results observed. Based on information provided in Coscia, the dramatic increase in press dewatering upon increasing the level of glyoxalation would not be expected whatsoever.

17. I further declare that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements and the like may jeopardize the validity of the present application or any patent issuing thereon.

Dated: Dec. 11, 2008

Signed: Michael R St John
Michael R. St. John